Workshop Without Walls: Upstairs Downstairs

Breakout Group 2 Note-taking

How do we get past single pixel of ambiguity from observations?
What measurements do we hope to have?

Resolving surface characteristics: temperature/pressure
Other surface features (in addition to atmospheric) features

-color = oxidation state?, presence of an ocean vs. land?
-presence of clouds, cloud composition (will help to uncover surface processes), ***temporal variation/seasonality*** => provide insights into weathering
-presence of hazes, composition/chemistry => insights into surface and atmospheric chemical processes
-H2 escape estimates applied to wider variety of exoplanets
-aerosols (sulfates)

Chemical species:

NH3: could be very telling, though we see it (abiotically) in jupiter's atmosphere, serves as antifreeze so it is important for characterizing presence of liquid water

N2: background pressure medium

Isotopes:

-CO2 vs Methane (13C) in atmosphere could yield bio vs abio-insights, could be VERY powerful biosignature (seasonal changes)

-CO2, O2, and CH4 concentration variations could tell about a seasonal biosphere consuming and producing (and on colder planets solid CO2 sublimating and freezing, hinting at how much land mass is present)

-H2O isotopes and concentrations might help say something about evaporation/precipitation/ weather (requires greater resolution or temporal changes)

Pigments: in an anoxic world non-oxygenic photosynthetic pigments might be present at the surface. (ideally temporal and better spectral resolution would be required).
Nancy weighs in on pigments: The vegetation red edge has no major mineralogical false positives. We don't know why exactly pigments on Earth absorb where they do. Starlight and molecular energetic constraints both play a role, but evolutionary history appears to be important, making predictability for exoplanets difficult. - Evidence that life on Earth is still evolving to push the limits of the light spectrum.

The power of staring for a long time:

-Lots of seasonal changes in Earth atmosphere due to life!

-Can composition between transit and eclipse observations be confidently compared or not, since the different methods may yield different systematic results.